PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B30B 9/04, 11/02, 11/26

A1

(11) International Publication Number: **WO 97/27994**

(43) International Publication Date: 7 August 1997 (07.08.97)

(21) International Application Number: PCT/IT97/00018

(22) International Filing Date: 24 January 1997 (24.01.97)

(30) Priority Data:
BO96A000044 31 January 1996 (31.01.96) IT

(71) Applicant *(for all designated States except US)*: SAITEC S.R.L. [IT/IT]; Via Medesano, 36, I-40023 Castel Guelfo (IT).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: RODRIGUEZ, Lorenzo [IT/IT]; Via Macchiavelli, 2, I-40069 Zola Predosa (IT). CINI, Maurizio [IT/IT]; Via Alamandini, 3, I-40136 Bologna (IT). CAVALLARI, Cristina [IT/IT]; Via P. Palagi, 18, I-40138 Bologna (IT). MOTTA, Giuseppe [IT/IT]; Via Alessandrini, 6, I-40126 Bologna (IT).

(74) Agent: LANZONI, Luciano; Bugnion S.p.A., Via dei Mille, 19, I-40121 Bologna (IT).

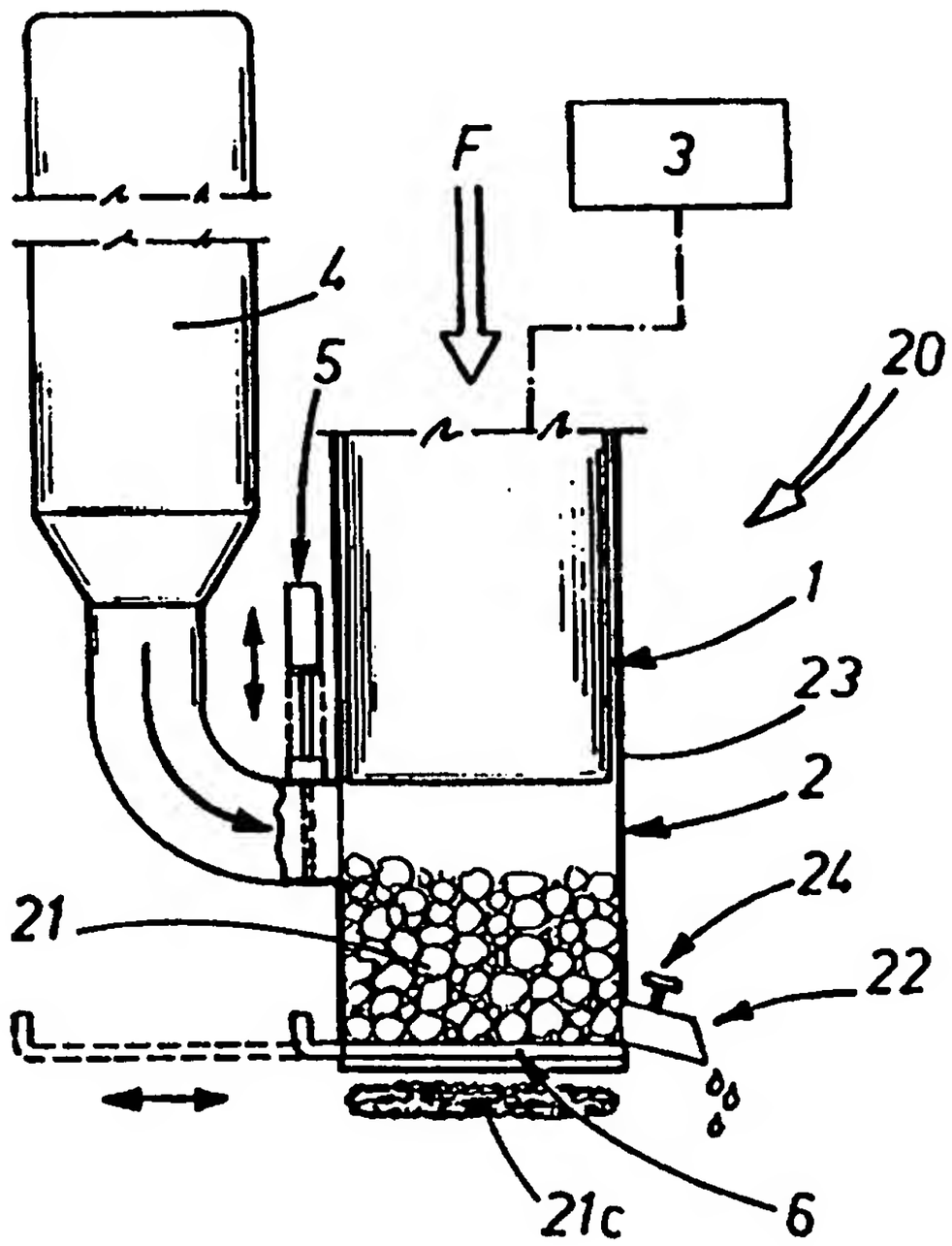
(81) Designated States: AU, BG, BR, CA, CN, CZ, FI, HU, JP, KR, MX, NO, NZ, PL, RO, RU, SI, SK, UA, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A PROCESS AND APPARATUS FOR PRESSING MATERIALS

(57) Abstract

The invention relates to a process and apparatus (20) for pressing materials (21) in which a material (21) is compressed by a piston that vibrates lengthways at an ultrasonic frequency to reduce the compression resistance of the material and to augment the compression effect; in practice, "static" compression, whereby an element is moved under the effect of pressure applied to it, is replaced by a succession of high-frequency blows; the process can be used in particular for squeezing materials of vegetable or animal origin in order to extract the juices from them and for manufacturing processes involving materials subject to plastic deformation.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	**GB**	United Kingdom	**MW**	Malawi
AT	Austria	**GE**	Georgia	**MX**	Mexico
AU	Australia	**GN**	Guinea	**NE**	Niger
BB	Barbados	**GR**	Greece	**NL**	Netherlands
BE	Belgium	**HU**	Hungary	**NO**	Norway
BF	Burkina Faso	**IE**	Ireland	**NZ**	New Zealand
BG	Bulgaria	**IT**	Italy	**PL**	Poland
BJ	Benin	**JP**	Japan	**PT**	Portugal
BR	Brazil	**KE**	Kenya	**RO**	Romania
BY	Belarus	**KG**	Kyrgystan	**RU**	Russian Federation
CA	Canada	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CF	Central African Republic			**SE**	Sweden
CG	Congo	**KR**	Republic of Korea	**SG**	Singapore
CH	Switzerland	**KZ**	Kazakhstan	**SI**	Slovenia
CI	Côte d'Ivoire	**LI**	Liechtenstein	**SK**	Slovakia
CM	Cameroon	**LK**	Sri Lanka	**SN**	Senegal
CN	China	**LR**	Liberia	**SZ**	Swaziland
CS	Czechoslovakia	**LT**	Lithuania	**TD**	Chad
CZ	Czech Republic	**LU**	Luxembourg	**TG**	Togo
DE	Germany	**LV**	Latvia	**TJ**	Tajikistan
DK	Denmark	**MC**	Monaco	**TT**	Trinidad and Tobago
EE	Estonia	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**UG**	Uganda
FI	Finland	**ML**	Mali	**US**	United States of America
FR	France	**MN**	Mongolia	**UZ**	Uzbekistan
GA	Gabon	**MR**	Mauritania	**VN**	Viet Nam

Description

A process and apparatus for pressing materials

Technical Field

The present invention relates to a process and apparatus for pressing materials.

The invention relates in particular, but without restricting the scope of the inventive concept, to the pressing of materials of vegetable origin in order to extract the juices and to the pressing of materials subject to plastic deformation such as materials extruded to form pellets for zootechnical applications.

Background Art

According to known technology, processes for the extraction of substances such as oils or pharmaceutical active ingredients in liquid form or in solvent solutions from the solid materials of vegetable origin containing them include a mechanical pressing stage effected in mechanical or hydraulic presses.

In some cases, the material to be processed, in addition to being mechanically pressed, is also heated by steam and, in other cases still, heating may be substituted by, or combined with, the use of solvents.

Obviously, the characteristic pressure parameters of these processes differ from one material to another. However, one disadvantage of all the processes known to prior art of the type described above is that they require high-intensity compressive forces, applied for considerable lengths of time and resulting in high energy consumption.

Accordingly, the apparatus used to apply the compressive forces with sufficiently high intensity must be very large, having structures that are complex and expensive to make.

Moreover, the use of process fluids such as steam and solvents further increases the complexity of the apparatus because the latter must be equipped with systems to supply the fluids during the process and then to remove them when their action has been completed.

A further disadvantage is that, in some cases, the temperature of the steam and/or of the solvents may adversely affect the properties of the material being processed.

Disclosure of the Invention

It is an aim of the present invention to provide a process for pressing materials which overcomes the drawbacks mentioned above. Another aim of the invention is to provide a process that can be advantageously used for materials that are to be subjected to plastic deformation, as in extrusion, for example.

The invention achieves these and other aims by providing a pressing process in which the material is subjected to a mechanical pressing stage combined with an ultrasonic vibration stage. These two stages are carried out at the same time by a sonotrode pressure element that vibrates at an ultrasonic frequency.

The ultrasonic energy which goes through the material during the mechanical pressing stage produces the surprising effect of modifying the internal state of the material so as to considerably reduce the resistance offered by the material to the pressure exerted on it. The mechanical compression of the material therefore requires less force.

Compared to conventional processes, the pressing process achieved by the present invention is much more efficient because it requires much less power. In fact, all other conditions being equal, the process disclosed by the present invention, compared to a pressing process using a conventional press, reduces by two orders of magnitude the compressive force required and the length of time for which the force must be applied.

Another advantage of the invention is that it is effective at ambient temperature and therefore there is practically no deterioration of the material as a result of temperature.

Since the compressive forces are considerably reduced, the apparatus required is much simpler, more economical and longer lasting.

Moreover, no process fluids are required, with obvious advantages in terms of simplicity of construction and operation of the apparatus required to implement the process.

Yet another advantage of the invention is that, if applied to materials subject to plastic deformation, it produces the same degree of deformation at low temperature that conventional processes, under equal conditions of compression, can only achieve at much higher temperatures.

This, besides being more economical in general, is particularly useful when processing temperature-sensitive materials since it totally removes, or at least greatly reduces, the importance of heating as a stage in the process which is particularly critical and expensive.

The present invention also provides an apparatus for pressing materials which implements the process described above.

The characteristics of the invention are laid out in the claims below and the advantages of the disclosure are apparent from the detailed description which follows, with reference to the accompanying drawings, which illustrate preferred embodiments of the invention and in which:

Figures 1 and 2 schematically illustrate the apparatus that implements the process in two examples of possible applications.

With reference to Fig. 1, the numeral (20) indicates an apparatus used for pressing materials (21) and basically comprising a sonotrode pressure element (1) consisting of a piston connected to ultrasound generator means (3) and mounted in such a way that it can slide in a cylindrical metal container (2). A force indicated by the arrow (F) in Figs. 1 and 2 moves the sonotrode pressure element (1) alternately between a backward position, in which it is at rest, and a forward position, in which it is at work on the material (21).

The container (2) is interconnected with a hopper (4) for feeding the material (21) and equipped with a metering valve (5), preferably a gate valve, which opens when the sonotrode pressure element (1) is at the rest position in order to fill the container (2) by gravity feed or by forced feed (for example, using a screw feeder, not illustrated here) and closes when the pressure inside

the container (2) is high enough to indicate that the material (21) being compressed is likely to overflow.

The container (2) is also equipped with appropriately shaped means (22), fitted to the bottom end of a side surface (23) of the container (2), designed to tap the juices pressed out of the material (21) and, if necessary, also equipped with valves (24) that are synchronized with the alternating motion of the sonotrode pressure element (1).

At the front of the sonotrode pressure element (1), the container (2) preferably has a wall (6) that can be opened to enable removal of residue material (shown as a broken line and labelled 21c in Fig. 1) at the end of the compression process.

The apparatus (20) can be conveniently used to implement a process for pressing a material (21) of vegetable origin in order to squeeze the juices it contains out of it. By way of example, without restricting the scope of the invention, the apparatus (20) can be used in processes for the cold extraction of oils, pharmaceutical active ingredients in liquid form and/or in liquid solvent solutions.

In another embodiment of the apparatus (20), illustrated schematically in Fig. 2, the apparatus (20) can be used for pressing materials (21) subject to plastic deformation such as those used in conventional extrusion processes. In this case, the wall (6) has holes in it to produce rods (26) of compressed material and is equipped with means (25) to cut the rods (26) into pellets (27).

When used for this application, the apparatus has several advantages over heated screw extruders currently used to extrude thermoplastic materials. It is suitable in particular for the production of animal feed, dietary supplements and pharmaceuticals in the form of pellets which often contain substances which are highly sensitive to temperature. Thanks to the process and apparatus disclosed by the present invention, these can be manufactured without significant heating and hence without affecting their properties.

Moreover, the apparatus (20) facilitates plastic deformation to such a great extent that it can be used to pelletize materials

(21) to which pelletizing processes according to conventional methods are at present difficult, if not impossible, to apply. It is therefore evident that the invention as described above fully achieves its aims, and, moreover, is simple in construction and, hence, economical.

The invention described can be subject to modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

In practice, modifications and improvements can be made which fall within the scope of the claims set out hereunder.

Claims

1. A process for pressing materials by means of mechanical compression characterized in that the stage of mechanical compression is combined with a stage in which the material (21) is vibrated at an ultrasonic frequency.

2. The process according to claim 1 characterized in that the said ultrasonic vibration stage is carried out at the same time as the mechanical compression stage.

3. The process according to claim 1 characterized in that the said mechanical compression and ultrasonic vibration stages are carried out by the same actuator.

4. The process according to claim 3 characterized in that the said actuator comprises a pressure element (1) connected to means (3) for generating ultrasounds and mounted in such a way that it can slide inside a container (2) for the said material.

5. The process according to claim 1 characterized in that it can be applied to a material of vegetable origin to squeeze out the juices it contains.

6. The process according to claim 5 characterized in that it can be carried out at ambient temperature and without further heating.

7. The process according to claim 1 characterized in that it can be applied to a material of animal origin to squeeze out the juices it contains.

8. The process according to claim 7 characterized in that it can be carried out at ambient temperature and without further heating.

9. The process according to claim 1 characterized in that it can be applied to materials (21) subject to plastic deformation.

10. The process according to claim 9 characterized in that the said materials can be pelletized.

11. The process according to claim 9 characterized in that the said materials fall into the categories of animal feeds, dietary supplements and temperature-sensitive pharmaceuticals.

12. An apparatus for pressing materials characterized in that it comprises at least one pressure element (1) connected to means (3) for generating ultrasounds and mounted in such a way that it can slide inside a container (2) of the said material (21) to be pressed.

13. The apparatus according to claim 12 characterized in that the said container (2) is interconnected with a hopper (4) for feeding the material.

14. The apparatus according to claim 13 characterized in that the said feed hopper (4) is equipped with a metering valve (5).

15. The apparatus according to claim 12 characterized in that it comprises means attached to the container (2) for tapping the juices squeezed out of the materials.

16. The apparatus according to claim 12 characterized in that the container (2) is equipped with a wall (6) that can be opened in order to remove the material after pressing.

17. The apparatus according to claim 12 where the said materials (21) have plastic deformation properties characterized in that the said container (2) is equipped with an end wall (6) with holes in it to produce rods (26) of compressed material pressed by the pressure element (1).

18. The apparatus according to claim 17 characterized in that the said end wall (6) is equipped with means (25) for cutting the rods (26) into pellets (27) when the said rods (26) are pressed out through the end wall (6).

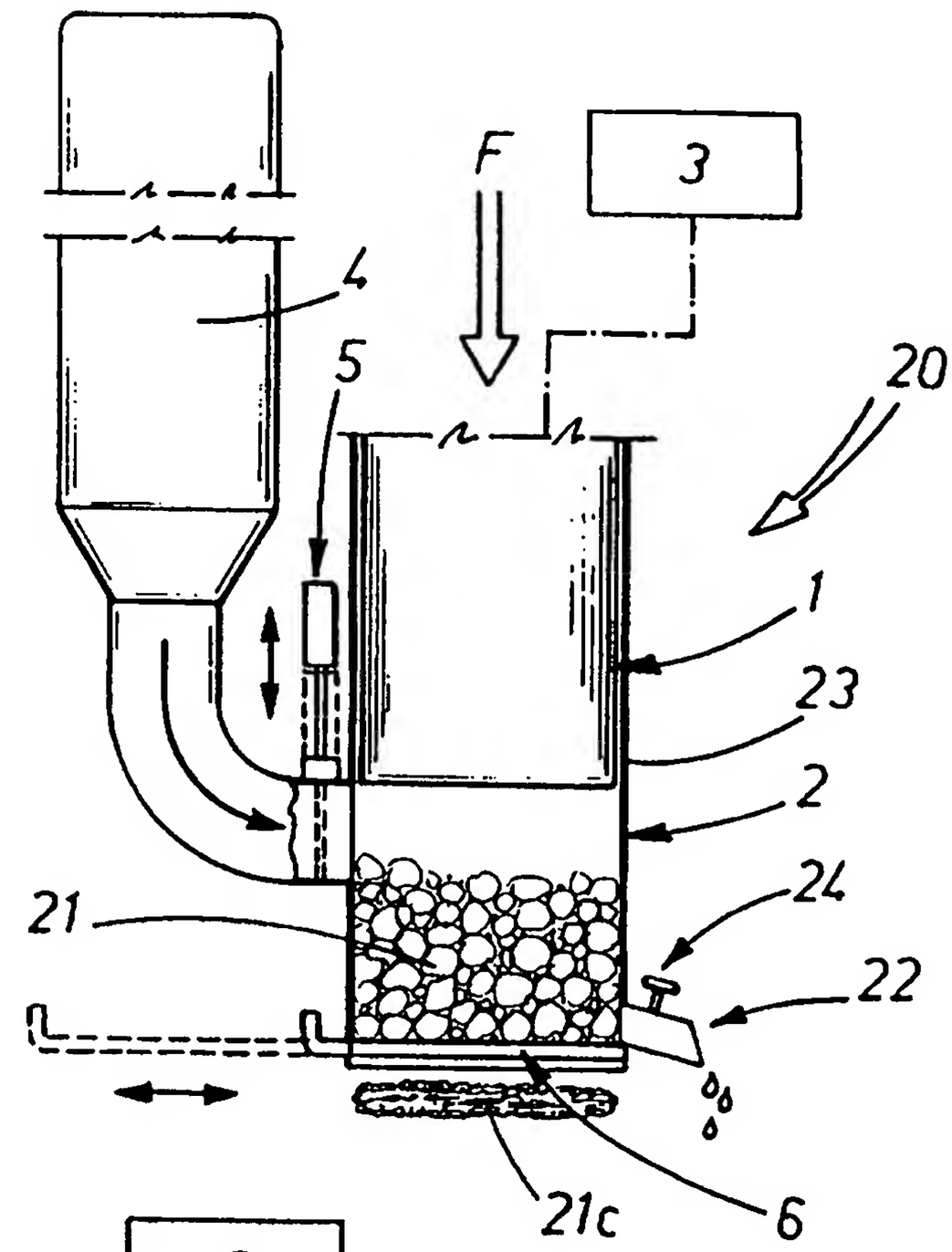


FIG1

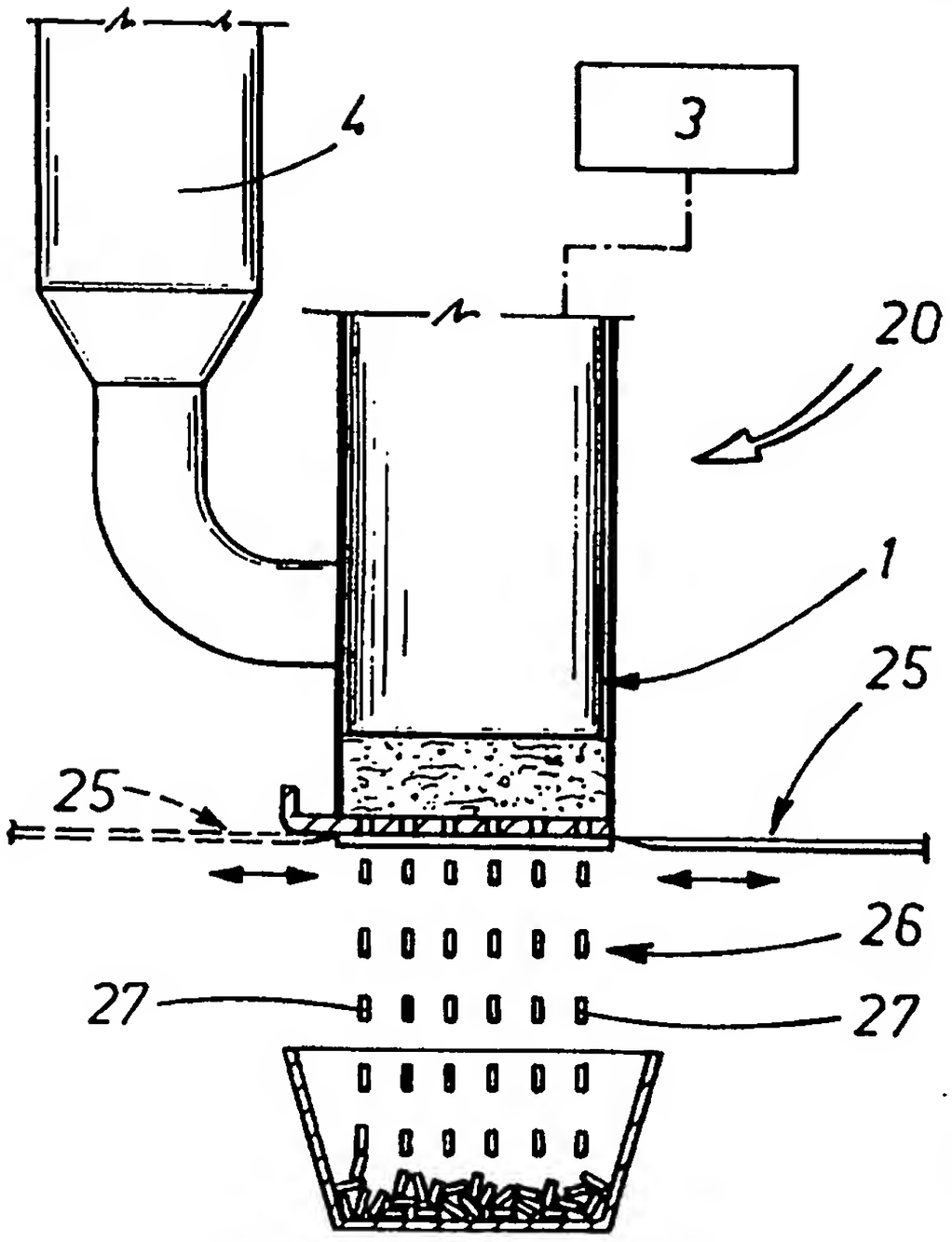


FIG2

INTERNATIONAL SEARCH REPORT

Inter onal Application No
PCT/IT 97/00018

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B30B9/04 B30B11/02 B30B11/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B30B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 304 656 A (LEE JEOUNG-KYU) 8 December 1981 see the whole document ---	1-4,12, 15,16
X	EP 0 054 005 A (SCHELLING MARIO ;SCHELLING BRUNO (CH); SCHELLING ARMIN (CH)) 16 June 1982	1,2,5,6, 9,12,16
Y	see the whole document ---	10,11, 17,18
X	PATENT ABSTRACTS OF JAPAN vol. 005, no. 022 (M-054), 10 February 1981 & JP 55 149800 A (EBARA INFILCO CO LTD), 21 November 1980, see abstract; figures --- -/--	1

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
21 May 1997	02.06.1997

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Voutsadopoulos, K

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inter. ...nal Application No
PCT/IT 97/00018

C.(Conunuat·on) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 006, no. 040 (C-094), 12 March 1982 & JP 56 158111 A (EBARA INFILCO CO LTD), 5 December 1981, see abstract; figures ---	1
X	PATENT ABSTRACTS OF JAPAN vol. 005, no. 004 (C-038), 13 January 1981 & JP 55 134619 A (EBARA INFILCO CO LTD), 20 October 1980, see abstract; figures ---	1
Y	DE 20 47 398 A (SLOAN) 8 April 1971 see claims; figures -----	10,11, 17,18

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. nal Application No
PCT/IT 97/00018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4304656 A	08-12-81	JP 56099290 A	10-08-81
		BR 8008635 A	28-07-81
EP 0054005 A	16-06-82	JP 57123296 A	31-07-82
DE 2047398 A	08-04-71	GB 1263422 A	09-02-72
		US 3611951 A	12-10-71